» Kontron User's Guide «

IPMI Firmware User Guide

for the

CP6016

Board

Manual ID: 1035-7980 Rev. 1.1

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1. Copyright

2. Revision History

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4. Introduction

4.1 Acronym Definitions

BMC	Baseboard Management Controller In a compact CPCI chassis, there can be only one BMC present. The BMC administrates the SEL and the SDRR for the complete system. The BMC is connected to the other boards in the shelf via a dedicated bus (IPMB-0). The CP6016 management controller can be set in SMC mode and in BMC mode by an IPMI OEM command. The factory setting is SMC.
BSP	Board Support Package
FRU	Field Replaceable Unit Every board is a FRU. The FRU data contains information about the board such as the part number and the serial number. See PICMG Specification 2.9 for complete details on the FRU data structure. The free Linux tool 'ipmitool' [1] can be used to update or to display the FRU data.
FWH	Firmware Hub. Memory location where a complete EFI code is stored.
I^2C	Inter-Integrated Circuit
IPMB	Intelligent Platform Management Bus The dedicated I^2C management bus where the BMC and the SMCs communicate.
IPMB-0	Intelligent Platform Management Bus which connects all SMCs with the BMC or a Shelf Manager.
IPMI	Intelligent Platform Management Interface.
KCS	Keyboard Controller Style (Interface) This is the IPMI mandatory interface on the host system (payload) to communicate with the BMC.
MP	Management Power. This powers the BMC's or SMC's controller and is available as soon as the board is inserted. The Handle switch needs not be closed for that.
PICMG	PCI Industrial Computer Manufacturer Group
PWR	Payload Power. This powers the host side of the board where the application software runs. It is granted by the BMC or SMC after all prerequisites are met. prerequisites are a closed handle switch, power on the backplane etc.
SDR	Sensor Data Record This is the IPMI data structure that defines a sensor.
SDRR	Sensor Data Record Repository Is the device in the BMC where all SDRs of the chassis' boards are administrated. A free Linux utility named 'ipmitool' [1] makes a full chassis discovery and fills the SDRR with the SDRs being found. The factory default repository contains only the local board's SDRs. TODO refer to ipmitool
SEL	System Event Log Is the device in the BMC where all the events in the chassis which are reported are administrated. If an event occurs on any board, the sensor event is sent throught the IPMB bus to the BMC which additionally stores its own events as well.
SMBIOS	System Management BIOS
SMS	System Management Software (designed to run under the OS)

SMC	Satellite Management Controller In a compact PCI chassis, there can be many SMCs. Each SMC is connected to the BMC via a dedicated bus (IPMB-0). The CP6016 management controller can be set in SMC mode and in BMC mode by an IPMI OEM command. The factory setting is SMC.

4.2 Related Documentation

IPMI specifications: (http://www.intel.com/design/servers/ipmi/spec.htm)

IPMI-Intelligent Platform Management Interface Specification v1.5 Document revision 1.1, February 2002

Addenda, Errata, and Clarifications document revision 4 for IPMI v1.5 rev 1.1 specification

IPMI- Intelligent Platform Management Bus Communications Protocol Specification v1.0 Document Revision 1.0, November 1999

IPMI- IPMB v1.0 Address Allocation Document Revision 1.0, September 1998

[3] IPMI- Platform Management FRU Information Storage Definition v1.0 Document Revision 1.1, September 1999

PICMG specifications: http://www.picmg.org

PICMG 2.9 R1.0 CompactPCI System Management Specification, February 2000

PICMG 3.0 R2.0 AdvancedTCA Base Specification, March 2005

Open tools documentation

[1] ipmitool documentation: http://ipmitool.sourceforge.net. Refer as well to “12, OS Support / Tools”

[2] OpenIPMI documentation: http://www.openipmi.sourceforge.net . Refer as well to “12, OS Support / Tools”

Kontron manuals and specifications: http://www.kontron.com/

CP6016 User Guide

4.3 Product Overview

This product fully supports Intelligent Platform Management Interface 1.5 (IPMIv1.5) and PICMG 2.9 R1.0 specifications. All its functionalities run under an autonomous management controller even if the board is held in reset or power down by a management card within a system designed for High Availability such as XL-VHDS or XL-LP42.

While the CP6016 IPMI implementation is fully compliant to IPMI v1.5 and should work with any System Management Software that respects this specification, it has been designed to be easily integrated with the Service Availability Forum-Hardware Platform Interface (SAF-HPI) specification.

You can find more information about the IPMI at the following Web site:

http://www.saforum.org/home

IPMI is an extensible and open standard that defines autonomous system monitoring. It is autonomous because every management controller within a compact PCI chassis monitors its own sensors and sends critical events through a dedicated bus to a Baseboard Management Controller (BMC) that logs it into a non volatile System Event Log (SEL). The CP6016 IPMI implementation includes a device SDR repository module that allows the user's System Management Software (SMS) to discover all system's components and to build a database of all management controller sensors.

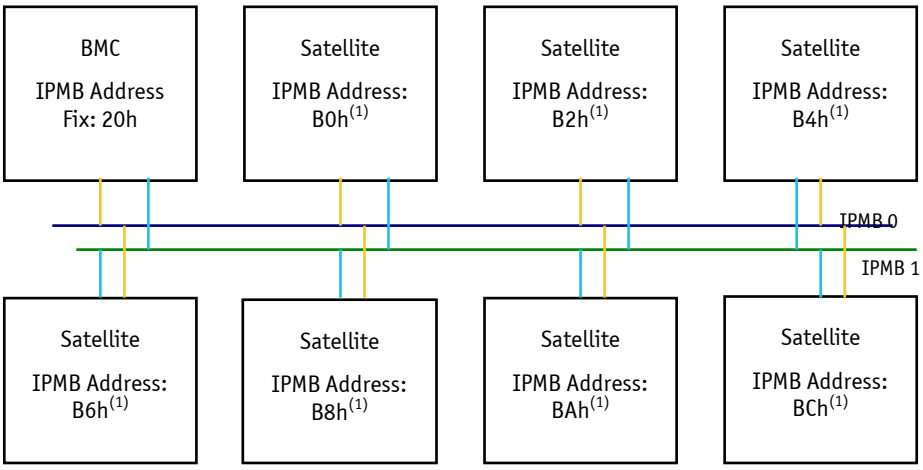
You can find more information about the IPMI at the following Web site:

http://www.intel.com/design/servers/ipmi/

5. IPMI Setup

5.1 IPMI in a Compact PCI Chassis

Kontron's IPMI implementation in the cPCI environment is compliant to the PCMIG 2.9 R1.0 specification. The specification defines the pinout of J1 and J2 as well as the addressing scheme. There should be only one BMC in the chassis, or at least on the IPMB segment. The BMC may reside either on an SBC blade or on an external system management card (SMC) or in a shelf management controller (ShMC). The specification allows all of these variants.



(1) IPMB address for satellte is determined via the location of the slot in the chassis.

To use the IPMI resources in a rack, some steps are needed. The system operator must perform the following steps.

5.2 IPMI Setup for the CP6016

First of all the IPMI Management Controller of the CP6016 has to be configured. For the first time please use the EFI shell and "kipmi" command with option parameters.

Simple "kipmi" command displays possible options for this command.

"kipmi mode" command shows current controller mode – BMC or SMC. This command provide you possibility also to change this setting by issuing "kipmi mode smc" (Satellite) or "kipmi mode bmc" (Baseboard). Depends on the function of the CP6016's IPMI controller you need.

Result issuing "kipmi ipq" command provides information about currently selected IRQ/lack of irq used for KCS interface communication. Additional parameter 10,11 or 0 sets IRQ configuration to IRQ10, IRQ11 or no IRQ.

The default factory setting of a CP6016 is "SMC, IRQ 11". If it is that what you want you need not enter the EFI shell. When storing the configuration, the EFI creates an 'IPMI Device Information Record (Type 38h)' entry in the SMBIOS table. This record contains information about:

Supported IPMI specification revision (v1.5)

type of the supported interface (KCS style)

chosen interrupt (10, 11 or none).

This information is needed by the IPMI OS kernel drivers for Linux during their loading time. After the loading most available IPMI communications tools which access the IPMI controller via IPMI OS drivers should work (e.g. ipmicmd, ipmitool [1] etc.). Now it's possible to use such a tool to issue the "Set Firmware Parameters" OEM IPMI command (refer to 8.2.2, Set Firmware Parameters) to modify the configuration again. But the change of the interrupt number always needs a EFI restart for a correct set up of the SMBIOS table.

5.3 IPMI Setup for the rack

For a working IPMI configuration the SDRR of the BMC has to be filled with all sensors data records of all IPMI controllers in the rack. After every system start the BMC uses the SDRR to initialize all sensors of all boards. The SDRR setup must be done by a management tool e.g. the open Linux tool 'ipmitool' [1]. The command then is

```
ipmitool sdr fill sensors
```

This will only work if the IPMI controller of the BMC is addressed. This addressing is the default if you use ipmitool on the payload side of the board where the BMC is residing.

6. Management Controller Hardware

On the CP6016 module, the Management Controller is implemented using the Renesas H8S/2166 controller with 512 kB of internal Flash and 40 kB of RAM. An additional 1 MB serial SPI FLASH memory chip (if implemented) provides redundant firmware image storage. A separate 32 kB serial EEPROM chip is used for firmware private data and 4 kB EEPROM serves as FRU Inventory storage.

The Management Controller circuit implements two local Keyboard Style Interfaces (KCS) with interrupt support for communication with system side management software and EFI. The Management Controllers in the rack are all connected by the IPMB-0 bus.

The Management Controller implements a wide range of sensors that permit the monitoring of:

main power voltages: 5V (PWR), 3.3V, 5V (MP), 1.5V, 1.8V, 0.9V (DDR) ,

temperatures: CPU die temperature, chipset temperature and 3 board temperatures

Power Good, IPMB-0 link, board reset, post code, boot error, processor state, Health error, IPMI watchdog etc.

7. Management Controller Firmware

7.1 Key Features

Compliant with IPMI specification 1.5, revision 1.1

Compliant with PICMG 2.9 specification

Firmware designed and specially made for compact PCI implementation and easy integration with SAF-HPI

KCS SMS interface with interrupt support

Dual Port IPMB configurable as two independent channels or in redundant mode (refer to 8.2.2, Set Firmware Parameters).

Out of band management and monitoring using IPMB interface permits access to sensors regardless of the board's CPU state

Sensor thresholds fully configurable

Sensor names prefixed with identification of owner (BMC without slot number or SMC with slot number)

Complete IPMI watchdog functionality

Complete SEL, SDR repository and FRU functionality on BMC

Complete FRU functionality

Master Write-Read I2C supports for external I2C devices communications (FRU, EEPROM, FAN).

If the SPI FLASH memory is implemented:

- Two IPMI controller firmware banks allow an automatic backup. This allows manual and automatic firmware image roll-back (in case of upgrade failure).
- The downloading of a new firmware image does not break currently running firmware or payload activities (refer to 7.2.2, Firmware Upgrade).
- Firmware bank management is done by the open tool ipmitool [1] (function fwum) which can update the firmware in the field.

Firmware fully customizable to the customer's needs by OEM IPMI commands (refer to 8.2.2, Set Firmware Parameters).

FRU data can be updated in the field by the open tool ipmitool [1] (function fru write)

Interoperable with other IPMI solutions

OEM board supervision and control extensions such as boot device flash selection (refer to 7.2.4.2, Boot Flash Selection by OEM IPMI Command) and firmware boot order configuration (refer to 7.2.4.4, Boot Order selection by OEM IPMI).

Automatic switching to an alternative EFI image after having detected a not working EFI (refer to 7.2.4.3, Automatic Boot Flash Selection during the Boot Process).

Graceful shutdown support (refer to 7.2.5., Hot Swap and Shut Down).

Handle switch and blue Hot Swap LED are working like on an ATCA blade (refer to 7.2.5., Hot Swap and Shut Down).

An “Out of Service” (OOS) LED shows whether the IPMI controller is working and pulses when there is IPMB-0 traffic (refer to 10., IPMI Communication LEDs).

The “Health” LED shows the IPMI controller’s heartbeat and pulses if the KCS interface is active (refer to 10., IPMI Communication LEDs).

The board’s write protection feature for all non volatile memories is supported. These memories are a) I^2C EEPROM for FRU data and parameters, b) SPI FLASH memory for firmware banks (if implemented).

7.2 Firmware Code

7.2.1 Structure and Functionality

The IPMI controller firmware code is organized into boot code and operational code, both of which are stored in a flash module. Upon an IPMI controller reset, the IPMI controller first executes the boot code which does:

A self test to verify the status of the Management Controller’s hardware including its memory.

Performs a checksum of the operational code.

After successful verification of the operational code checksum, the firmware will jump to the operational code.

Only the operational code is upgradeable in-the-field.

7.2.2 Firmware Upgrade

Only if the SPI FLASH memory is implemented and no write protection is set:

The standard way to upgrade the IPMI controller’s operational code is to use the open tool ‘ipmitool’ [1] together with an image file. Ipmitool allows the downloading (‘ipmitool fwum download …’) and activation (‘ipmitool fwum upgrade’) of the new operational code and saves an existing one. The rollback to the formerly running operational code is possible as well (‘ipmitool fwum rollback’). The status command (‘ipmitool fwum status’) displays what firmware is stored and in what state it is (‘last known good’ = running, ‘previous good’ = running before upgrade).

All IPMI interfaces which are offered by ipmitool (KCS interface, IPMB bus, LAN) are usable for the upgrade. This allows local upgrade and remote upgrade. Please note that KCS and LAN interfaces are only usable on a powered payload.

Files which contain an image of operational code have the board name “CP6016” and the string “FWUM” in its name.

During the download process the currently running operational code is still operating in a normal way until the upgrade command is issued. During the now starting upgrade process the IPMI controller is off line for about 20 seconds when the boot code is re-organizing the firmware storage. Afterwards the new operational code is started. If the new operational code doesn’t operate well, e.g. hangs, the boot code will perform an automatic rollback to the last working operational code and start this again.

7.2.3 Firmware / Module Identification

There are two ways to verify by means of IPMI that the Management Controller resides on a CP6016.

The response on the IPMI command “Get Device ID” offers among others the following response data:

Manufacturer ID = 3A98h (Kontron IANA ID)

Device ID = 04h (H8S2166)

Product ID = 6016 which means that the board is a CP6016

Firmware Revision in bytes 4:5 - depends on the core version of the running firmware.

The SDR revision in byte 13 (OEM part of the response) is a sub revision of the firmware revision. It is unique for all versions of the board’s firmware i.e. the Firmware Revision mentioned above is not really needed for the identification of the firmware.

The Device ID String which can be found by reading the Management Controller Device Locator Record (SDR Type 12h) contains the string “BMC:CP6016”. For e.g. the ipmitool [1] command ‘ipmitool sdr list mcloc’ the Device ID Strings of all available boards will be displayed. If the CP6016 is a BMC for it this string will be displayed without change. If the CP6016 is a SMC then the string will be changed into “Sxx: CP6016” where xx is the slot number where the board is residing, e.g. “S09: CP6016”.

7.2.4 The Payload Boot Process

When the CP6016’s payload starts, the first code to be executed is the EFI. There are two Flash devices, numbered 0 and 1, which may contain different EFI code. Which one of them will be selected from the **next** boot process on is selectable this way:

a. The contents of a user (payload) writeable register (refer to the CP6016 User Guide) tells which Boot Flash to use. This is the primary selection.

b. The firmware’s parameter EEPROM contains a parameter which’s value decides whether to invert the primary selection register’s contents or not when the Management Controller’s firmware selects the boot flash. For this the Management Controller sets or resets a control signal which inverts or inverts not the boot flash selection.

7.2.4.1 Boot Flash Selection by writing to a board register

Please refer to the CP6016 User Guide.

7.2.4.2 Boot Flash Selection by OEM IPMI Command

The OEM IPMI command “Set Control State” (refer to 8.2.3, Set Control State (Firmware Hub/EFI Flash, Boot Order)) adjusts whether the Management Controller has to invert the register based Flash selection or not from the **next** boot process on. The Management Controller stores this decision in a parameter in the EEPROM. Please refer to 8.2.3, Set Control State (Firmware Hub/EFI Flash, Boot Order).

7.2.4.3 Automatic Boot Flash Selection during the Boot Process

After each payload reset the Management Controller selects the boot flash by applying the related EEPROM parameter. Physically the Management Controller sets or resets a signal line. Afterwards it waits for a special message from the EFI. This message contains the checksum report, i.e. it reports whether the boot Flash’s checksum is right or wrong. If the checksum is wrong or the message is not received within 60 seconds, then the currently used EFI Flash is assumed to contain an invalid or a corrupted image. In this case the Management Controller toggles the parameter value in the EEPROM and issues a “Boot Error (Invalid boot sector) event” by setting the appropriate sensor value (sensor ‘FWHx Boot Err’. x = 0..1). x is simply the value of the parameter in EEPROM and not the absolute number of the used boot flash. Afterwards it causes a payload off-no cycle and continues as being described at the beginning of this chapter. When a timeout error is recognized and the count of boot errors exceeds 2 or when a checksum error is recognized and the count of boot errors exceeds 4 the Management Controller gives up, i.e. causes no more payload reset to stabilize the system. Not until the next payload power on event the Management Controller will care about booting.

7.2.4.4 Boot Order selection by OEM IPMI

Normally the EFI will apply the boot order which was selected in the EFI menu “Boot/Boot Option Priorities”. But there is another alternative boot order which is held in the Management Controller’s non volatile memory. This boot order can be set and read by IPMI OEM commands (refer to 8.2.3., Set Control State (Firmware Hub/EFI Flash, Boot Order) and 8.2.4., Get Control State (Firmware Hub/EFI Flash, Boot Order)). At payload start the Management Controller writes it into a register where the EFI can read it. If this Management Controller’s boot order has a non zero value the EFI will use it instead of its own boot order. Please refer to 8.2.3, Set Control State (Firmware Hub/EFI Flash, Boot Order).

7.2.4.5 Communication between Management Controller and EFI

For communication between EFI and Management Controller there is a “private” KCS interface. During the boot process the EFI sends the following IPMI commands to the Management Controller:

An OEM command which reports a good or a bad checksum.

A Standard IPMI command “Set Watchdog Timer” to stop a possibly running IPMI watchdog timer.

A Standard IPMI command “Set SEL Time” to set the event log time to the time which is kept by the RTC.

An OEM IPMI command (refer to 8.2.2, Set Firmware Parameters) with some parameters which e.g. set the Management Controller to a BMC or a SMC as selected in the EFI shell.

A Standard IPMI command “Set ACPI Power State” to set the state “ACPI legacy on”

Etc.

7.2.5 Hot Swap and Shut Down

7.2.5.1 Handle Switch and Hot Swap (blue) LED

As a hot-swappable field replaceable unit (FRU), the CP6016 behaves like an ATCA blade and internally uses similar “M-states”. The blue Hot Swap LED (HS LED) of an inserted board in a powered rack in general shows the board’s Hot Swap state:

On = the board is inactive and may be a) activated by closing the Handle Switch or b) may be extracted. The “M-state” is 1. An **exception** is the case when module power is off e.g. after a shut down and the handle is still closed. We have here the M-state 4. To show the operator that the power is off the blue LED will be on in spite of the closed handle.

Blinking = changing from active state to inactive state or vice versa. Don’t extract the board now. The “M-state” is 2, 5 or 6.

Off = the board is active. Don’t extract the board now. Normally the extraction is impossible because the Handle Switch is closed. The “M-state” is 3 or 4.

Normally the logical states “active” and “inactive” of a board are identical to the physical states “handle open” and “handle closed” or “payload power on” and “payload power off”. But this is only true if we exclusively use the Handle Switch to select the board’s state.

If we e.g. switch the power on or off using an IPMI chassis commands or we let shut down the payload by the OS then the position of the handle switch and the power state necessarily might become asynchronous. This is avoided by a special behavior of the blue LED in that case. Please refer to the description of ‘on’ state above.

Example 1: The handle switch is closed, the blue LED is off and power is on. If we switch off power by the IPMI chassis command the blue LED will be switched on despite the handle is still closed. The states of the LED and the position of the handle switch are not corresponding in this case but for the operator it is easier to be notified by the glowing LED that this board needs service. If we now switch on the power again by an IPMI chassis command the LED will be switched off again. The position of the handle switch again is corresponding with the power state. Another possibility is to power up the module is to open the handle and to wait until the blue LED stops blinking and stays on. The closing of the handle then powers up the module.

Example 2: The handle switch is closed, the blue LED is off and power is on. If we use an OS with ACPI support a “Shut Down” command will lead us to the state “payload power off” and the blue LED will be switched on despite the handle is still closed. The states of the LED and the position of the handle switch are not corresponding in this case but for the operator it is easier to be notified by the glowing LED that this board needs service. To power up the board again we can proceed like in example 1 (see above).

7.2.5.2 The Hot Swap and Shut Down processes

When we open the Handle Switch of a board which’s payload is running we want to switch the payload off i.e. shut the power down in a way which causes no loss of data. We aim the same if we order the operating system (OS) to perform a “Shut Down”.

We must distinguish here between three scenarios. We might have on payload side …

1) …a “dumb” OS which doesn’t support ACPI at all.
2) …an OS which supports ACPI.
3) …a “dumb” OS which doesn’t support ACPI but behaves towards the Management Controller as if it supports ACPI. This will be treated like 2)

A “hot Swap” or a “Shut down” in a system 2) or 3) which is normally caused by an operator’s command will both end in a “Graceful Shut Down”.

A “Graceful Shut Down” denotes a shut down where all processes are terminated before the power is switched off.

7.2.5.2.1 Dumb system with no ACPI support

After payload power on the starting EFI will inform the Management Controller by sending the IPMI command “Set ACPI Power State / Set Legacy on”. This means that a Hot Swap (opening of a closed handle) shall immediately lead to a power off by the Management controller. The operator is responsible for the termination of processes to avoid the loss of date.

7.2.5.2.2 System having ACPI support

When after EFI there is an OS starting which supports ACPI, this will cause the transmission of the IPMI command “Set ACPI Power State / S0/G0 working” to the Management Controller. This means that the OS has reprogrammed the chip set in a manner that a “power button” signal doesn’t lead to an immediate power off but only causes an event that can be detected by the OS.

Case 1, Hot Swap:
When the handle switch is opened, the Management Controller pulls the “power button” signal to notify the OS. The OS then will shut down all processes and afterwards will cause the transmission of the IPMI command “Set ACPI Power State / S5/G2 soft off” to the Management Controller which will now switch the power off. Please note that the Management Controller will switch off the power immediately if no more that 20 seconds have elapsed between entering “S0/G0” state and Hot Swap. This is to speed up the Hot Swap while the OS has not yet started an application

Case 2, Shut Down:
When the OS is forced by the user to perform a shut down it will shuts down all processes. Afterwards it will cause the transmission of the IPMI command “Set ACPI Power State / S5/G2 soft off” to the Management Controller which will now switch the power off.

7.2.5.2.3 System which emulates ACPI support

An OS which not really supports ACPI like e.g. VxWorks is able to get “Graceful Shut Down” support from the Management Controller if it behaves in the following way.

After start such an OS has to manipulate the chip set in a way that prevents an immediate power off on a “power button” signal.

Then it has to send the IPMI command “Set ACPI Power State / S0/G0 working” to the Management Controller to enable this to process later a “S5/G2 soft off” command.

During its run time the system shall cyclically read the “Hot Swap Sensor” (sensor #0) using the IPMI command “Get Sensor Reading”. This allows the tracking of the board’s state. After the board has once reached “M-state” 4 (sensor reading is 10h) the leaving of this announces that the handle switch was opened. Now the time has come to terminate all processes.

After all critical processes have been terminated the OS has to send the IPMI command “Set ACPI Power State / S5/G2 soft off” to the Management Controller which will set the power off immediately.

7.2.6 Setting of the SEL time

The Management Controller has no own hardware real time clock. Therefore after start, restart or upgrade of the Management Controller first its software clock has to be supplied with the current time. The Management Controller uses the time when handling event messages which otherwise will have an out-of-date time stamp.

Every time when the EFI comes up it supplies the Management Controller with the payload’s current real time clock time. A problem is a re-start of the Management Controller without a following EFI start. Because during re-start the Management Controller’s time gets lost it must be set again by issuing the IPMI command “Set SEL Time”. This may be done by application software on the payload side via the KCS interface or by a remote Management Controller via the IPMB-0.

7.3 LAN functions

7.3.1 Overview

The two Ethernet channels which reside on RearIO (channel 2 and channel 3) in parallel to their ‘normal’ use - be used for the following special purposes:

IPMI over LAN (IOL)
Serial over LAN (SOL)

Common for both kinds of communication is the use of the RMCP/RMCP+ for the packing of the data to be transferred. On Ethernet the port 623 is used for transfers with this protocol.

While IOL serves to transport IPMI commands and their responses the SOL serves to transport any serial data. In each case the IPMC serves as a protocol encoder and decoder. Please note that IOL is able to use both RMCP and RMCP+ protocols. SOL works only with the RMCP+ protocol.

Please note, that IOL and SOL need the Ethernet device to be powered. Therefore the module (payload) must be fully powered.

7.3.2 Setting up the Ethernet channel

There are two methods to prepare the IPMIC's SOL and IOL LAN parameters for the two possible Ethernet channels:

During EFI shell setup

By use of the open tool 'ipmitool' or IPMI commands

The setup methods are compatible i.e. both methods show the parameters which are set by the other one, however ipmitool provides access to more options, including SOL.

The setup is separate for both channels. When the MAC addresses are set the ones which are programmed into the hardware have to be re-used. This is a restriction. The IP addresses of a channel being used by 'normal' payload traffic and IOL/SOL traffic may differ but need not differ as long as the RMCP port 623 is not used in parallel by payload and IOL/SOL.

7.3.2.1 Setup by EFI shell

The EFI shell setup provides "kipmi" family of commands. The "kipmi" command with option "net" is used to query and set ipmi LAN related options. Calling "kipmi net 2" should print current configuration of channel 2 and display possible setting options. After adjusting possible parameters IOL should be ready to work. Note that here are no SOL specific configuration options.

7.3.2.2 Setup by ipmitool

The open tool ipmitool offers commands for the setup of the two Ethernet channels. All possible options are showed by issuing

ipmitool lan set

If ipmitool is not usable the LAN parameters can be set by using the generic IPMI commands which are defined for this e.g. by ipmicmd.

To show the current LAN parameters for a channel ipmitool offers the command

Ipmitool lan print <channel = 1, 2>

7.3.3 Setup of user and password

The open tool ipmitool offers commands for the listing and manipulation of user accounts for channel 1 and 2. An overview can be obtained by putting in

ipmitool user

The predefined users for a channel can be listed by the command

ipmitool user list <channel = 1, 2>.

The CP6016 has for every channel these predefinitions in non volatile memory:

```
ID  Name             Callin  Link Auth  IPMI Msg   Channel Priv Limit
1                    false   true       true       USER
2   admin            false   true       true       ADMINISTRATOR
```

Please note that admin's password is preset with 'admin'.
Changed users and passwords stay valid after payload power off.

The user must be activated by

ipmitool user enable <user number>

7.3.4 IPMI over LAN (IOL)

IPMI over LAN is used for to communicate with an IPMI controller as e.g. the CP6016's IPMC via LAN using the RMCP or RMCP+ protocol. The data which is transferred are IPMI commands and the responses to them.

To enable the LAN support after parameter setup this command has to be issued:

ipmitool lan set <channel = 2, 3> access on

Please note that the following commands must use the IP address which belongs to the enabled channel.

The open tool 'ipmitool' can serve as a control program and user interface for this. ipmitool allows to issue generic IPMI commands as e.g.:

ipmitool -I lanplus -H 192.168.3.189 -U admin -P admin –A PASSWORD raw 6 1

or to call complex functions like 'mc .info':

ipmitool -I lanplus -H 192.168.3.189 -U admin -P admin –A PASSWORD mc info

This uses many generic IPMI commands to get all needed information.

7.3.5 Serial over LAN (SOL)

Serial over LAN connects the **COM0** or **/dev/ttyS0** respectively of the CP6016's payload side to an Ethernet channel. The IPMC resides between this serial interface and one of the Ethernet channels. It serves as an encoder and a decoder for the used RMCP+ protocol and controls the data stream. Outside the CP6016 e.g. the open tool ipmitool can be used to drive the SOL session i.e. it offers a console function to communicate via Ethernet with the CP6016's serial interface.

The serial interface can be used as a connection
1) to a user program on the CP6016 payload, or
2) to the EFI console redirection function. Refer to the EFI setup menu "Advanced>Serial Port Console Redirection". There the serial parameters for this purpose can be set. Please note that after EFI start, the OS gets active in most cases (except e.g. DOS) and the

console redirection stops working because the OS doesn't use EFI functions to drive the console.

3) to a Linux login console. This can be activated after payload start e.g. by the command

```
getty –h 9600 /dev/ttyS0
```

4) etc.

SOL supports and requires serial hardware handshake. This should be activated for the serial port. Otherwise transmitted data might get lost. In any case the same serial parameters for the used payload side serial interface and the IPMC's serial interface have to be used. The parameters for the IPMC's serial interface can be set by the "ipmitool sol set …" command. Calling "ipmitool sol set" shows all options that can be set.

Other commands which are possible are showed when issuing "ipmitool sol help".

7.4 XMC Card Support

The CP6016 is ready for the insertion of XMC card.

The presence or absence of XMC card is reported by sensor "XMC preset" (refer to sensor description).

If XMC card is present the card's FRU data EEPROM is readable/writable. The size of EEPROM must be smaller or equal to 256 bytes, because of 8-bit EEPROM addressing. Note that XMC FRU size is always reported as 256 bytes and writing to part that exceeds real capacity should be avoided.

The FRU ID for XMC FRU data is always 1.

8. Supported IPMI Commands

8.1 Standard Commands

Part of the command list in IPMI specification 2.0

M = mandatory, O = optional

	IPMI 2.0 Spec. section	NetFn	CMD	Kontron support On IPMC
IPM Device "Global" Commands				**M**
Get Device ID	20.1	App	01h	M / **Yes [1]**
Cold Reset	20.2	App	02h	O / **Yes**
Warm Reset	20.3	App	03h	O / No
Get Self Test Results	20.4	App	04h	O / **Yes**
Manufacturing Test On	20.5	App	05h	O / No
Set ACPI Power State	20.6	App	06h	O / No
Get ACPI Power State	20.7	App	07h	O / No
Get Device GUID	20.8	App	08h	O / No
Broadcast "Get Device ID"	20.9	App	01h	M / **Yes**
BMC Watchdog Timer Commands				**O**
Reset Watchdog Timer	27.5	App	22h	O / **Yes**
Set Watchdog Timer	27.6	App	24h	O / **Yes**
Get Watchdog Timer	27.7	App	25h	O / **Yes**

BMC Device and Messaging Commands				O
Set BMC Global Enables	22.1	App	2Eh	O / **Yes**
Get BMC Global Enables	22.2	App	2Fh	O / **Yes**
Clear Message Flags	22.3	App	30h	O / **Yes**
Get Message Flags	22.4	App	31h	O / **Yes**
Enable Message Channel Receive	22.5	App	32h	O / **Yes**
Get Message	22.6	App	33h	O / **Yes**
Send Message	22.7	App	34h	O / **Yes**
Read Event Message Buffer	22.8	App	35h	O / **Yes**
Get BT Interface Capabilities	22.9	App	36h	O / **Yes**
Get System GUID	22.14	App	37h	O / No
Get Channel Authentication Capabilities	22.13	App	38h	O / No
Get Session Challenge	22.15	App	39h	O / No
Activate Session	22.17	App	3Ah	O / No
Set Session Privilege Level	22.18	App	3Bh	O / No
Close Session	22.19	App	3Ch	O / No
Get Session Info	22.20	App	3Dh	O / No
Get AuthCode	22.21	App	3Fh	O / No
Set Channel Access	22.22	App	40h	O / No
Get Channel Access	22.23	App	41h	O / No
Get Channel Info	22.24	App	42h	O / No
Set User Access	22.26	App	43h	O / No
Get User Access	22.27	App	44h	O / No
Set User Name	22.28	App	45h	O / No
Get User Name	22.29	App	46h	O / No
Set User Password	22.30	App	47h	O / No
Activate Payload	24.1	App	48h	O / No
Deactivate Payload	24.2	App	49h	O / No
Get Payload Activation Status	24.4	App	4Ah	O / No
Get Payload Instance Info	24.5	App	4Bh	O / No
Set User Payload Access	24.6	App	4Ch	O / No
Get User Payload Access	24.7	App	4Dh	O / No
Get Channel Payload Support	24.8	App	4Eh	O / No
Get Channel Payload Version	24.9	App	4Fh	O / No
Get Channel OEM Payload Info	24.10	App	50h	O / No
Master Write-Read	22.11	App	52h	O / **Yes**
Get Channel Cipher Suits	22.15	App	54h	O / No
Suspend/Resume Payload Encryption	24.3	App	55h	O / No
Set Channel Security Keys	22.25	App	56h	O / No
Get System Interface Capabilities	22.9	App	57h	O / No

Chassis Device Commands				**O / Yes**
Get Chassis Capabilities	28.1	Chassis	00h	O / **Yes**
Get Chassis Status	28.2	Chassis	01h	O / **Yes**
Chassis Control	28.3	Chassis	02h	O / No
Chassis Reset	28.4	Chassis	03h	O / No
Chassis Identify	28.5	Chassis	04h	O / No
Set Chassis Capabilities	28.7	Chassis	05h	O / No
Set Power Restore Policy	28.8	Chassis	06h	O / No
Get System Restart Cause	28.11	Chassis	07h	O / No
Set System Boot Options	28.12	Chassis	08h	O / No
Get System Boot Options	28.13	Chassis	09h	O / No
Get POH Counter	28.14	Chassis	0Fh	O / **Yes [2]**
Event Commands				**M**
Set Event Receiver	29.1	S/E	01h	M / **Yes**
Get Event Receiver	29.2	S/E	02h	M / **Yes**
Platform Event (a.k.a. “Event Message”)	29.3	S/E	03h	M / **Yes**
PEF and Alerting Commands				**O**
Get PEF Capabilities	30.1	S/E	10h	O / No
Arm PEF Postpone Timer	30.2	S/E	11h	O / No
Set PEF Configuration Parameters	30.3	S/E	12h	O / No
Get PEF Configuration Parameters	30.4	S/E	13h	O / No
Set Last Processed Event ID	30.5	S/E	14h	O / No
Get Last Processed Event ID	30.6	S/E	15h	O / No
Alert Immediate	30.7	S/E	16h	O / No
PET Acknowledge	30.8	S/E	17h	O / No

Sensor Device Commands				**M**
Get Device SDR Info	35.2	S/E	20h	M / **Yes**
Get Device SDR	35.3	S/E	21h	M / **Yes**
Reserve Device SDR Repository	35.4	S/E	22h	M / **Yes**
Get Sensor Reading Factors	35.5	S/E	23h	O / No
Set Sensor Hysteresis	35.6	S/E	24h	O / **Yes**
Get Sensor Hysteresis	35.7	S/E	25h	O / **Yes**
Set Sensor Threshold	35.8	S/E	26h	O / **Yes**
Get Sensor Threshold	35.9	S/E	27h	O / **Yes**
Set Sensor Event Enable	35.10	S/E	28h	O / **Yes**
Get Sensor Event Enable	35.11	S/E	29h	O / **Yes**
Re-arm Sensor Events	35.12	S/E	2Ah	O / No
Get Sensor Event Status	35.13	S/E	2Bh	O / No
Get Sensor Reading	35.14	S/E	2Dh	M / **Yes**
Set Sensor Type	35.15	S/E	2Eh	O / No
Get Sensor Type	35.16	S/E	2Fh	O / No
FRU Device Commands				**M**
Get FRU Inventory Area Info	34.1	Storage	10h	M / **Yes**
Read FRU Data	34.2	Storage	11h	M / **Yes**
Write FRU Data	34.3	Storage	12h	M / **Yes**
SDR Device Commands				**O**
Get SDR Repository Info	33.9	Storage	20h	O / **Yes**
Get SDR Repository Allocation Info	33.10	Storage	21h	O / **Yes**
Reserve SDR Repository	33.11	Storage	22h	O / **Yes**
Get SDR	33.12	Storage	23h	O / **Yes**
Add SDR	33.13	Storage	24h	O / **Yes**
Partial Add SDR	33.14	Storage	25h	O / **Yes**
Delete SDR	33.15	Storage	26h	O / **Yes**
Clear SDR Repository	33.16	Storage	27h	O / **Yes**
Get SDR Repository Time	33.17	Storage	28h	O / No
Set SDR Repository Time	33.18	Storage	29h	O / No
Enter SDR Repository Update Mode	33.19	Storage	2Ah	O / No
Exit SDR Repository Update Mode	33.20	Storage	2Bh	O / No
Run Initialization Agent	33.21	Storage	2Ch	O / **Yes**

SEL Device Commands				**O**
Get SEL Info	40.2	Storage	40h	O / **Yes**
Get SEL Allocation Info	40.3	Storage	41h	O / **Yes**
Reserve SEL	40.4	Storage	42h	O / **Yes**
Get SEL Entry	40.5	Storage	43h	O / **Yes**
Add SEL Entry	40.6	Storage	44h	O / **Yes**
Partial Add SEL Entry	40.7	Storage	45h	O / No
Delete SEL Entry	40.8	Storage	46h	O / **Yes**
Clear SEL	40.9	Storage	47h	O / **Yes**
Get SEL Time	40.10	Storage	48h	O / **Yes**
Set SEL Time	40.11	Storage	49h	O / **Yes**
Get Auxiliary Log Status	40.12	Storage	5Ah	O / No
Set Auxiliary Log Status	40.13	Storage	5Bh	O / No
LAN Device Commands				O
Set LAN Configuration Parameters	23.1	Transport	01h	O / Yes
Get LAN Configuration Parameters	23.2	Transport	02h	O / Yes
Suspend BMC ARPs	23.3	Transport	03h	O / Yes
Get IP/UDP/RMCP Statistics	23.4	Transport	04h	O / Yes
Serial/Modem Device Commands				O
Set Serial/Modem Configuration	25.1	Transport	10h	O / No
Get Serial/Modem Configuration	25.2	Transport	11h	O / No
Set Serial/Modem Mux	25.3	Transport	12h	O / No
Get TAP Response Codes	25.4	Transport	13h	O / No
Set PPP UDP Proxy Transmit Data	25.5	Transport	14h	O / No
Get PPP UDP Proxy Transmit Data	25.6	Transport	15h	O / No
Send PPP UDP Proxy Packet	25.7	Transport	16h	O / No
Get PPP UDP Proxy Receive Data	25.8	Transport	17h	O / No
Serial/Modem Connection Active	25.9	Transport	18h	O / No
Callback	25.10	Transport	19h	O / No
Set User Callback Options	25.11	Transport	1Ah	O / No
Get User Callback Options	25.12	Transport	1Bh	O / No
SOL Activating	26.1	Transport	20h	O / Yes
Get SOL Configuration Parameters	26.2	Transport	21h	O / Yes
Set SOL Configuration Parameters	26.3	Transport	22h	O / Yes

AdvancedTCA®[10]	PICMG® 3.0 Table			**M**
Get PICMG Properties	3-9	PICMG	00h	M / **Yes**
Get Address Info	3-8	PICMG	01h	N/A
Get Shelf Address Info	3-13	PICMG	02h	N/A
Set Shelf Address Info	3-14	PICMG	03h	N/A
FRU Control	3-22	PICMG	04h	M / **Yes [3]**
Get FRU LED Properties	3-24	PICMG	05h	M / **Yes**
Get LED Color Capabilities	3-25	PICMG	06h	M / **Yes**
Set FRU LED State	3-26	PICMG	07h	M / **Yes**
Get FRU LED State	3-27	PICMG	08h	M / **Yes**
Set IPMB State	3-51	PICMG	09h	N/A
Set FRU Activation Policy	3-17	PICMG	0Ah	N/A
Get FRU Activation Policy	3-18	PICMG	0Bh	N/A
Set FRU Activation	3-16	PICMG	0Ch	N/A
Get Device Locator Record ID	3-29	PICMG	0Dh	M / **Yes**
Set Port State	3-41	PICMG	0Eh	N/A
Get Port State	3-42	PICMG	0Fh	N/A
Compute Power Properties	3-60	PICMG	10h	N/A
Set Power Level	3-62	PICMG	11h	N/A
Get Power Level	3-61	PICMG	12h	N/A
Renegotiate Power	3-66	PICMG	13h	N/A
Get Fan Speed Properties	3-63	PICMG	14h	N/A
Set Fan Level	3-65	PICMG	15h	N/A
Get Fan Level	3-64	PICMG	16h	N/A
Bused Resource	3-44	PICMG	17h	N/A
Get IPMB Link Info	3-49	PICMG	18h	N/A

[1] Has oem extensions. Please refer to 8.2.1, Get Device ID Command with OEM Extensions

[2] Response byte 2: hours, byte 3: minutes after module start. Bytes 4..6: void

[3] Only 1 = Cold Reset and 2 = Warm Reset

8.2 OEM Commands and Extensions

8.2.1 Get Device ID Command with OEM Extensions

	LUN	NetFn	CMD
Get Device ID command with OEM extensions	00h	App = 06h	01h

	Byte	Data Field
Request Data	-	-
Response Data	1	Completion Code
	2:12	Regular Get Device ID Command response fields
	13	Release number 1... of the IPMI controller firmware. The open ipmi tool ‘ ipmitool’ [1] displays this as ‘SDR’ in the answer on command ‘ipmitool fwum status’.
	14	Module Geographical Address (slot number): 1 ... = Module in chassis slot 1...
	15	Reserved
	16	Reserved

8.2.2 Set Firmware Parameters

The command below permits the selection of interrupts to be used during KCS communication.

Please not that parameters which are set while the board is write protected are only valid until the next IPMI firmware reset. Some ATCA carriers cause an additional IPMI firmware reset when the handle switch is closed.

	LUN	NetFn	CMD
Set Firmware Parameters	03h	OEM = 3Eh	05h

	Byte	Data Field
Request data	1	Reserved B4h
	2	Reserved 90h
	3	Reserved 91h
	4	Reserved 8Bh
	5	Cmd Flags [6:2] Reserved [1] 0b = get only, 1b = set parameters [0] 0b = do not reset, 1b = reset Management Controller after setting parameters
	6	Operating Modes [7:5] Reserved [4] 0b = IPMB in redundancy [3:1] Reserved [0] 0b = BMC, 1b = SMC
	7	IRQ number FFh = do not use interrupts 0Ah = use IRQ10 0Bh = use IRQ11 Any other values Reserved.
Response data	1	Completion code
	2	Cmd Flags

	3	Operating Modes
	4	IRQ number

8.2.3 Set Control State (Firmware Hub/EFI Flash, Boot Order)

Please not that parameters which are set while the board is write protected are only valid until the next IPMI firmware reset. Some ATCA carriers cause an additional IPMI firmware reset when the handle switch is closed.

	LUN	NetFn	CMD
Set Control State (Firmware Hub/EFI Flash, Boot Order)	00h	OEM = 3Eh	20h

	Byte	Data Field
Request data	1	Control ID 00h: EFI Flash selection 9Dh: EFI Boot Order Configuration
	2	Control State for EFI Flash selection: (These settings are stored in EEPROM and applied (to logic) each time the IPMI controller detects power-on) 00h = EFI Flash selection is not inverted 01h = EFI Flash selection is logically inverted Please note that this selection will be automatically toggled by the IPMI controller during a failing boot process. Other payload sided settings may additionally modify this selection. Control State for EFI Boot Order Configuration: 00h .. 07h = Selected EFI Boot Order Configuration. 00h selects the default Boot Order which is selected in the EFI menu. BIOS boot order configuration: 000b = Boot order is according to EFI setup (default) 001b = Next boot device class: FDD 010b = Next boot device class: HDD 011b = Next boot device class: CD-ROM 100b = Next boot device class: Network 101b = Next boot device class: USB FDD 110b = Next boot device class: USB HDD 111b = Next boot device class: USB CD-ROM (These settings are stored in EEPROM and applied (to logic) each time the IPMI controller detects power-on)
Response data	1	Completion code

8.2.4 Get Control State (Firmware Hub/EFI Flash, Boot Order)

	LUN	NetFn	CMD
Get Control State (Firmware Hub/EFI Flash, Boot Order)	00h	OEM = 3Eh	21h

	Byte	Data Field
Request data	1	Control ID 00h: EFI Flash selection 9Dh: EFI Boot Order Configuration
Response data	1	Completion code
	4	Current Control State (refer to 8.2.3, Set Control State (Firmware Hub/EFI Flash, Boot Order)

9. Board Sensors

The Management Controller includes many sensors for voltage or temperature monitoring and various others for pass/fail type signal monitoring.

Every sensor is associated with a Sensor Data Record (SDR). Sensor Data Records contain information about the sensors identification such as sensor type, sensor name, sensor unit. SDRs also contain the configuration of a specific sensor such as thresholds, hysteresis, event generation capabilities, etc. that specify the sensor's behavior. Some fields of the sensor SDR are configurable through IPMI v1.5 command and are set to a built-in initial value.

Module sensors that have been implemented are listed in the sensor list below.

9.1 Sensor List

The sensor name (ID string) has a name prefix which is 'NNN:' in the lists below. When reading the sensor name after module insertion this prefix becomes automatically adapted to the role (BMC or SMC) and the physical position (slot number) of the module in a rack. If the module's Management Controller is set up as a BMC the prefix will be 'BMC:' independent of the slot where it resides. If the module's Management Controller is set up as a SMC the prefix will be 'Sxx:' where xx is the slot number (e.g. 09).

The sensor number is the number which identifies the sensor e.g. when using the IPMI command "Get Sensor Reading". Please not that 'ipmitool' [1] accepts sensor numbers in decimal (e.g. '10') or hexadecimal (e.g. '0xa') notation.

Please note that the IPMI tool 'ipmitool' displays for command 'ipmitool sdr list' the contents of the sensor data record repository (SDRR) of the whole rack if the SDRR is generated. The generation of the SDRR has always to be done new after adding or subtracting any board to or from the rack. Refer to 5.3, *IPMI Setup for the rack*.

For OEM (Kontron) specific sensor types and reading types in the following table please refer to the next chapter.

SENSOR Number / ID string	SENSOR TYPE (CODE) / EVENT/READING TYPE (CODE)	Ass. Mask / Deass. Mask / Reading Mask	DESCRIPTION	Causes red Health LED on error *) / Reading Mask
0h / NNN:Hot Swap	ATCA/CTCA Hot Swap (F0h) / Sensor-specific (6Fh)	00FFh / 0000h / 00FFh	Hot swap sensor	N
1h / NNN:Temp CPU	Temperature (01h) / Threshold (01h)	7A95h / 7A95h / 3F3F	CPU die temperature	Y / 0F3Ch
2h / NNN:Temp Chipset	Temperature (01h) / Threshold (01h)	7A95h / 7A95h / 3F3F	Temp Chipset	Y / 0F3Ch
3h /	Temperature (01h) /	7A95h /	Temp Board 1	Y

SENSOR Number / ID string	SENSOR TYPE (CODE) / EVENT/READING TYPE (CODE)	Ass. Mask / Deass. Mask / Reading Mask	DESCRIPTION	Causes red Health LED on error *) / Reading Mask
NNN:Temp Board 1	Threshold (01h)	7A95h / 3F3F		/ 0F3Ch
4h / NNN:Temp Board 2	Temperature (01h) / Threshold (01h)	7A95h / 7A95h / 3F3F	Temp Board 2	Y / 0F3Ch
5h / NNN:Temp Board 3	Temperature (01h) / Threshold (01h)	7A95h / 7A95h / 3F3F	Temp Board 3	Y / 0F3Ch
6h / NNN:Pwr Good	Power supply (08h) / OEM (73h)	0000h / 0000h / 402Fh	Status of all power lines	N
7h / NNN:Pwr Good Evt	Power supply (08h) / OEM (73h)	402Fh / 402Fh / 402Fh	Power fail events for all power lines	Y / 402Fh
8h / NNN:Board 3.3V	Voltage (02h) / Threshold (01h)	2204h / 2204h / 1212h	Board 3.3V supply	Y / 0F3Ch
9h / NNN:Board 5VIPMI	Voltage (02h) / Threshold (01h)	2204h / 2204h / 1212h	Management Power (MP) 5V	Y / 0F3Ch
Ah / NNN:Volt Battery	Voltage (02h) / Threshold (01h)	2204h / 2000h / 1212h	Battery	Y / 0F3Ch
Bh / NNN:Board 1.8V	Voltage (02h) / Threshold (01h)	2204h / 2204h / 1212h	Board 1.8V supply	Y / 0F3Ch
Ch / NNN:Board Vtt.9V	Voltage (02h) / Threshold (01h)	2204h / 2204h / 1212h	DDR termination supply	Y / 0F3Ch
Dh / NNN:Board 5.0V	Voltage (02h) / Threshold (01h)	2204h / 2204h / 1212h	Board 5V supply	Y / 0F3Ch
Eh / NNN:Board 1.5V	Voltage (02h) / Threshold (01h)	2204h / 2204h / 1212h	Board 1.5V supply	Y / 0F3Ch
Fh / NNN:Fan1 Speed	Fan (04h) / Threshold (01h)	0000h / 0000h / 1B1Bh	Speed [rpm] Fan 1	N
10h / NNN:Fan2 Speed	Fan (04h) / Threshold (01h)	0000h / 0000h / 1B1Bh	Speed [rpm] Fan 2	N
11h / NNN:Last Reset	OEM (CFh) / 'digital' Discrete (03h)	0002h / 0000h /	Board reset event	N

SENSOR Number / ID string	SENSOR TYPE (CODE) / EVENT/READING TYPE (CODE)	Ass. Mask / Deass. Mask / Reading Mask	DESCRIPTION	Causes red Health LED on error *) / Reading Mask
		0003h		
12h / NNN:Slot System	Entity presence (25h) / Sensor-specific (6Fh)	0000h / 0000h / 0003h	Board is in System Slot (SYSEN)	N
13h / NNN:PCI Present	Entity presence (25h) / Sensor-specific (6Fh)	0000h / 0000h / 0003h	Board is selected (BDSEL) and in system slot (SYSEN)	N
14h / NNN:CTCA chassis	Entity presence (25h) / Sensor-specific (6Fh)	0000h / 0000h / 0003h	Value is always 1	N
15h / NNN:Board PwrOff	Power supply (08h) / 'digital' Discrete (03h)	0000h / 0000h / 0003h		N
16h / NNN:IPMI WD	Watchdog2 (23h) / Sensor-specific (6Fh)	010Fh / 0000h / 010Fh	IPMI Watchdog	Y / 010Fh
17h / NNN:IPMB State	IPMB status change (F1h) / Sensor-specific (6Fh)	000Fh / 0000h / 000Fh	IPMB-0 state (refer to PICMG 3.0 Rev 2.0, 3.8.4.1)	N
18h / NNN:ACPI State	System ACPI Power State (022h) / Sensor-specific (6Fh)	7FFFh / 0000h / 7FFFh	System ACPI Power State	N
19h / NNN:Health Error	Platform Alert (24h) / 'digital' Discrete (03h)	0000h / 0000h / 0003h	Aggregates states (power, temperatures etc.). Visualization by the Health LED.	N
1Ah / NNN:CPU 0 Status	Processor (07h) / Sensor-specific (6Fh)	0463h / 0400h / 04E3h	CPU status. Offset 0ah: "Processor Automatically Throttled"	Y / 0402h
1Bh / NNN:POST Value	POST value OEM (C6h) / Sensor-specific (6Fh)	4000h / 0000h / 40FFh	POST code value (port 80h)	N
1Ch / NNN:FWH0 BootErr	Boot error (1Eh) / Sensor-specific (6Fh)	0008h / 0008h / 0008h	Firmware Hub 0 (Boot Flash 0) boot error	Y / 0008h
1Dh / NNN:FWH1 BootErr	Boot error (1Eh) / Sensor-specific (6Fh)	0008h / 0008h / 0008h	Firmware Hub 1 (Boot Flash 1) boot error	Y / 0008h
1Eh / NNN:XMC present	Entity Presence (25h) / Sensor-specific (6Fh)	0000h / 0000h / 0003h	Presence of XMC board	N
1Fh / NNN:Pwr Denied	Platform Alert (24h) / 'digital' Discrete (03h)	0002h / 0002h /	1 = o.k., no alert, power not denied	N

SENSOR Number / ID string	SENSOR TYPE (CODE) / EVENT/READING TYPE (CODE)	Ass. Mask / Deass. Mask / Reading Mask	DESCRIPTION	Causes red Health LED on error *) / Reading Mask
		0003h		
20h / NNN:FRU Agent	OEM FRU Agent (C5h) / Discrete (0Ah)	0140h / 0000h / 0147h	FRU Initialization Agent state	Y / 0140h
21h / NNN:IPMC Storage	Management Subsystem Health (28h) / Sensor-specific (6Fh)	0002h / 0000h / 0003h	IPMI controller storage access error	Y / 0002h
22h / NNN:Firm Upg Mng	Firmware Upgrade Manager (C7h) / Sensor-specific (6Fh)	010Fh / 0000h / 010Fh	Status of Firmware Upgrade Manager	N
23h / NNN:IpmC Reboot	Platform Alert (24h) / 'digital' Discrete (03h)	0002h / 0000h / 0003h	2 = Management controller is (re-)booting	N
24h / NNN:Ver change	Firmware version change (2Bh) / Sensor-specific (6Fh)	0002h / 0000h / 0002h	Management controller's firmware version changed	N
25h / NNN:SEL State	Event Logging Disabled (10h) / Sensor-specific (6Fh)	003Ch / 0000h / 003Ch	State of event logging	N
26h / NNN:IPMI Info-1	OEM Firmware Info 1 (C0h) / OEM (70h)	0003h / 0000h / 7FFFh	For internal use only	N
27h / NNN:IPMI Info-2	OEM Firmware Info 2 (C0h) / OEM (71h)	0003h / 0000h / 7FFFh	For internal use only	N
28h / NNN:IniAgent Err	Initialization Agent (C2h) / 'digital' Discrete (03h)	0002h / 0000h / 0003h	Initialization Agent error status. Used on BMC only. 1 = error free	N
29h / NNN:Board Rev	OEM Board Revision (CEh)/ Sensor-specific (6Fh)	0000h / 0000h / 7FFFh	Board revision information	N

*) Please note that the "Health" LED is always red if the payload is not active (Blue Hot Swap LED is on).

9.2 Sensor Thresholds

SENSOR Number / ID string	1h / NNN:Temp CPU	2h / NNN:Temp Chipset	3h / NNN:Temp Board 1	4h / NNN:Temp Board 2	5h / NNN:Temp Board 3	8h / NNN:Board 3.3V
Lower non recoverable	-5 °C	-5 °C	-5 °C	-5 °C	-5 °C	n.a. [1]
Lower critical	-3 °C	-3 °C	-3 °C	-3 °C	-3 °C	3.111 V
Lower non critical	-1 °C	-1 °C	-1 °C	-1 °C	-1 °C	n.a. [1]
Normal min	0 °C	0 °C	0 °C	0 °C	0 °C	3.142 V
Nominal	80 °C	80 °C	75 °C	65 °C	65 °C	3.311 V
Normal max	90 °C	90 °C	80 °C	75 °C	75 °C	3.480 V
Upper non critical	95 °C	95 °C	85 °C	80 °C	80 °C	n.a. [1]
Upper critical	105 °C	105 °C	95 °C	90 °C	90 °C	3.511 V
Upper non recoverable	115 °C	115 °C	100 °C	95 °C	95 °C	n.a. [1]

Eh / NNN:Board 1.5V	Dh / NNN:Board 5.0V	Ch / NNN:Board Vtt.9V	Bh / NNN:Board 1.8V	Ah / NNN:Volt Battery	9h / NNN:Board 5VIPMI
n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]
1.411 V	4.687 V	0.833 V	1.695 V	1.987 V	4.709 V
n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]
1.431 V	4.752 V	0.843 V	1.715 V	2.002 V	4.752 V
1.509 V	5.013 V	0.902 V	1.803 V	3.003 V	5.013 V
1.578 V	5.251 V	0.970 V	1.901 V	3.604 V	5.251 V
n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]
1.597 V	5.338 V	0.980 V	1.921 V	3.634 V	5.295 V
n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]	n.a. [1]

[1] Not applicable i.e. not used and not settable

9.3 OEM sensor types and OEM sensor event/reading types

Specification of PICMG specific OEM sensors can be found in AdvancedTCA Base specification.

OEM SENSOR TYPE (CODE)	OEM EVENT/READING TYPE (CODE)	DESCRIPTION
Firmware Info 1 (C0h)	70h	Internal Diagnostic Data
Firmware Info 2 (C0h)	71h	Internal Diagnostic Data
Initialization Agent (C2h)	03h ('digital' Discrete)	Offsets / events: 0: Initialization O.K. 1: Initialization Error
FRU Agent (C5h)	0Ah (Discrete)	FRU initialization agent, using a standard reading type.
Post Value (C6h)	6Fh (sensor type specific)	Error is detected if the POST code is != 0 and doesn't change for a defined amount of time. In case of no error: Bits [7:0] = POST code (payload Port 80h) In case of error: Bits [15:0] = 4000h Data2 = POST code, low nibble Data3 = POST code, high nibble
Firmware Upgrade Manager (C7h)	6Fh (sensor type specific)	Offsets / events: 0 : First Boot after upgrade 1 : First Boot after rollback (error) 2 : First Boot after errors (watchdog) 3 : First Boot after manual rollback 4..7 : Reserved 8 : Firmware Watchdog Bite, reset occurred

OEM SENSOR TYPE (CODE)	OEM EVENT/READING TYPE (CODE)	DESCRIPTION
Board Reset (CFh)	03h ('digital' Discrete)	Data 2 contains the reset type: ...WARM = 0 ...COLD = 1 ...FORCED_COLD = 2 ...SOFT_RESET = 3 ...MAX = 4 Data 3 contains the reset source: ...IPMI_WATCHDOG = 0 ...IPMI_COMMAND = 1 ...PROC_INT_CHECKSTOP = 2 ...PROC_INT_RST = 3 ...RESET_BUTTON = 4 ...POWER_UP = 5 ...LEG_INITIAL_WATCHDOG = 6 ...LEG_PROG_WATCHDOG = 7 ...SOFTWARE_INITIATED = 8 ...SETUP_RESET = 9 ...UNKNOWN = 0xFF

OEM SENSOR TYPE (CODE)	OEM EVENT/READING TYPE (CODE)	DESCRIPTION	
e.g. for Power Good / Power Good Event	73h	Sensor-specific Offset	Event Bit set = o.k.
		0h	HS fault#
		1h	HS early fault#
		2h	DEG#
		3h	FAL#
		4h	n.a.
		5h	vccCore good
		6h	n.a.
		7h	n.a.
		8h	n.a.
		9h	n.a.
		Ah	n.a.
		Bh	n.a.
		Ch	n.a.
		Dh	n.a.
		Eh	vccMainGood
Board revision (CEh)	6Fh (sensor type specific)	Bits [7:0] = Board Revision number This corresponds to Board and PLD Revision register described in CP6016 board manual.	

10. IPMI Communication LEDs

10.1 Overview

There are three IPMI communication LEDs on the face plate.

Blue Hot Swap LED
Color: Blue = 1
Labeled: 'HS'
Meaning: Indicates the Hot Swap state of the inserted and powered module.
Meaning: On = a) Module may be extracted or
b) power is off (e.g. after shut down) and handle is closed
Blinking = Hot Swap active, don't extract
Off = Module in normal operation. Don't extract.
Index in IPMI commands "Get/Set LED State": 0

LED I0 (Out Of Service)
Color: Green / red = 3 / 2
Labeled: 'I0'
Meaning: Indicates the "Out Of Service" state of the powered module.
Behavior: Solid red = Management controller out of service or not programmed or in reset state
Off = Management controller is running
Pulsing green = Traffic on the IPMB-0 bus
Index in IPMI commands "Get/Set LED State": 1

LED I1 (Health)
Color: Green / red = 3 / 2
Labeled: 'I1'
Behavior: Blinking = Management controller is running, showing its heart beat.
Pulsing = KCS interface active.
Off = Management controller is not running.
Any action, green = No health error detected (refer to sensor "Health Error").
Any action, red = Health error detected.
Index in IPMI commands "Get/Set LED State"s: 2

10.2 Programming of the LEDs

All LEDs can be programmed by the IPMI commands "Set FRU LED State Command" although this is not recommended because they have a dedicated function. But lamp test will make sense.

LED I0 and I1 will not keep statically ON or OFF because they are continuously showing the activities of IPMB-0 and KCS interface which will be affected by the programming.

11. FRU Data

11.1 Structure and Functionality

The Management Controller provides 4 kB non-volatile storage space for FRU information.

Please refer to [3] which defines the structure of FRU data.

Full low level access to read or write a module's FRU Information is provided by regular IPMI FRU Device commands. Please be careful when writing FRU information directly using standard IPMI commands because there is no write protection. Damaging the FRU Information e.g. may confuse a shelf management software which uses the FRU data.

To avoid this damage there is a Kontron Linux tool 'frum' (refer to 12.1, *Linux*), which allows to display and partially modify FRU data. E.g. the 'frum' tool makes it easy to modify Product Info Area fields like Product Version or Product Serial Number.

11.2 Board Specific FRU Data

Supported are the following FRU data areas and data fields:

FRU Board Info Area

Manufacturing date / time

Board manufacturer	(C7): "Kontron"
Board Product Name	(C6): "CP6016"
Board Serial Number	(CF): "123456789012345" *)
Board Part Number	(C9): "123456789" *)
FRU File ID	(C7): "STD_R10"

FRU Product Info Area

Product manufacturer	(C7): "Kontron"
Product Name	(C6): "CP6016"
Product Part Number	(C2): "00" *)
Product Version	(D9): "00000000000000000000000000" **)
Product Serial Number	(D9): "00000000000000000000000000" **)
Asset Tag	(D9): "_____"**)
FRU File ID	(C7): "STD_R10"
CustomData	(D5): 'MAC=CC:CC:CC:CC:CC:CC' *)

*) Field will be modified during the manufacturing process

**) Field is free for user. Please note that changes need special care (checksums). Refer to [3].

11.3 Downloading the FRU Data

Normally the user doesn't need to download the FRU data because the module is supplied with it before shipping.

But if needed the standard way to download FRU information to the module is to use the open tool ‘ipmitool’ [1] for the download of an image file (e.g. ‘ipmitool fru write 0 <file name>’).

All IPMI interfaces which are offered by ipmitool are usable (KCS interface, IPMB bus, LAN). This allows local upgrade or remote upgrade. Please note that the KCS and LAN interfaces are only usable on a powered payload.

Please note that the writing of FRU data while the board is write protected will have no effect.

12. OS Support / Tools

12.1 Linux

Normally all drivers and kernel modules needed for communication between the payload sided software and the Management Controller firmware via the KCS interface come with the distribution. Newest sources can be downloaded from http://openipmi.sourceforge.net. There may be downloaded the OpenIPMI project as well. The OpenIPMI library package includes some applications and the needed libraries. One of the applications is 'ipmicmd' which makes it possible to send and receive raw IPMI sequences; another, the 'ipmi_ui', provides a higher level interface and thus it does not require deep IPMI knowledge from the user side.

Another very useful all-in-one tool is 'ipmitool' [1] (http://ipmitool.sourceforge.net). It provides a user friendly interface to many IPMI features and extensions, for example to PICMG LED control and for the upgrade of the IPMC's firmware ("ipmitool fwum…").

There is a Kontron Modular Computers' IPMI ToolKit which contains some tools for the customer for the monitoring and the maintenance of some IPMI functionalities.

The following command line tools are included in the IPMI Tool Kit:

frum: display and modification of FRU data

temptool: selection, display, and storage of temperature and voltage sensor values

All these tools are OpenIPMI based. This toolkit is available on the "AMC Kit CD". If this CD was not shipped with your module then please contact our support (support@kontron-modular.com).

Please refer to the manual "MAN_LIN_IPMI_TOOLKIT_0103.pdf" being included in the package.

Before using any of the tools mentioned above the needed OpenIPMI kernel modules have to be loaded if not yet done automatically at Linux start up:

```
# modprobe ipmi_si
# modprobe ipmi_devintf
```

Possibly there are access issues for device ipmi0 when calling ipmitool. To prevent that try the following command:

```
# chmod 777 /dev/ipmi0
```

